

High Performance AI Chip Test

高性能AI芯片测试

李凯

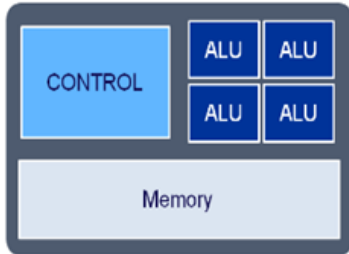
Application Consultant

Keysight Technology

AI 计算的芯片技术

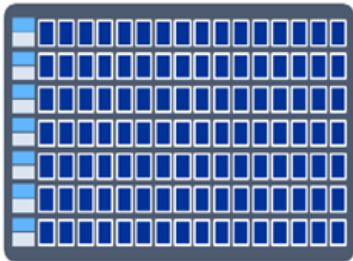
- 计算能力的加速

CPU



- Multi-purpose operations

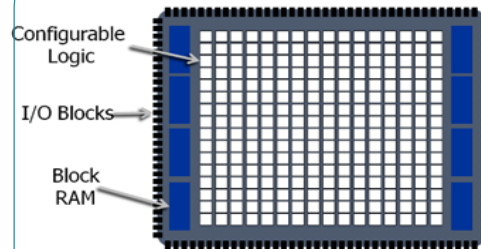
GPU



- Huge compute resources
- Parallel processing

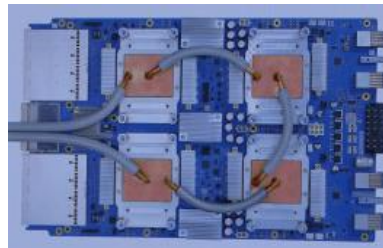
- 算法实现的加速

FPGA



- Flexible
- Computing efficiency

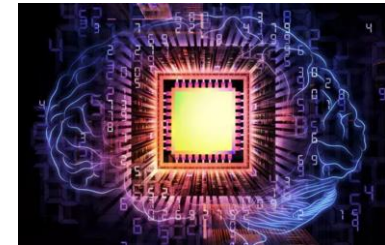
ASIC



- Application optimized

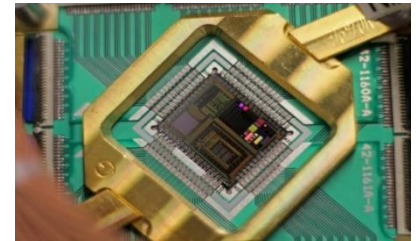
- 计算科学的革新

Neuromorphic



- Brain-like computation
- Energy efficient

Quantum computing



- Storage capacity increased exponentially
- Less power & fast speed

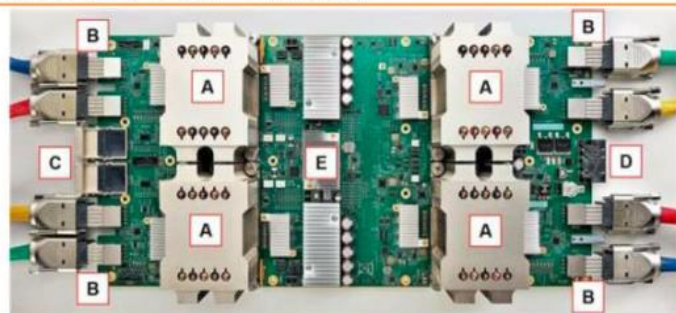
异构计算在AI领域的普遍应用

FPGA 加速卡



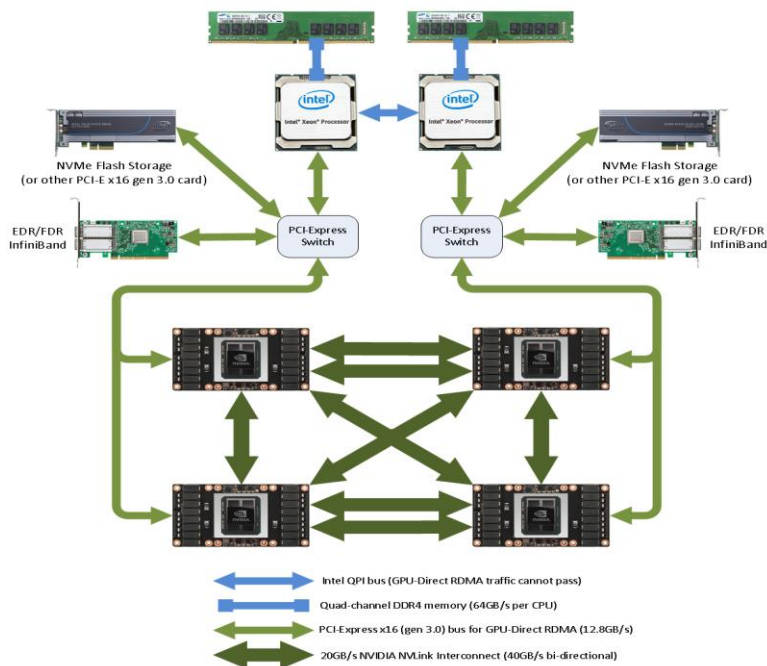
TPU (ASIC) 服务器

A 是第二代 TPU 及散热片, B 是每块 TPU 的 2 根 BlueLink 25GB/s 电缆, C 是 Omni-Path 架构(OPA) 电缆接口, D 是电源连接器背面, E 可能为网络交换机

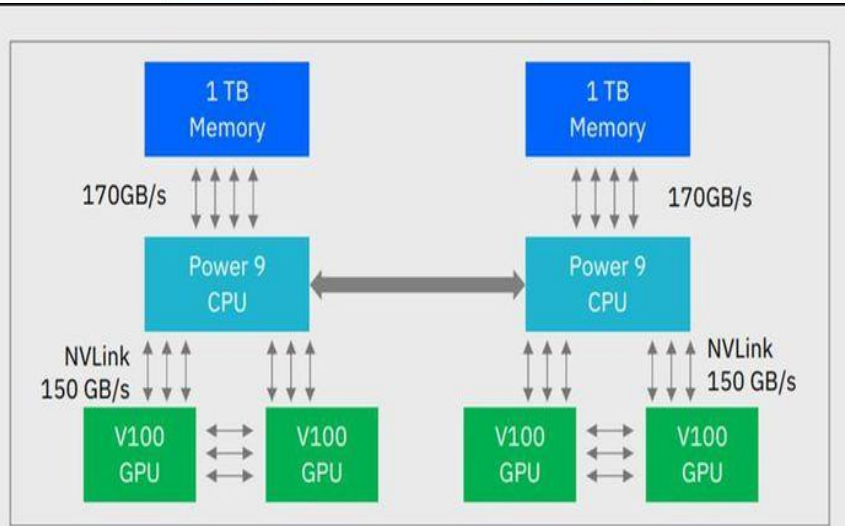


GPU 服务器

NumberSmasher 1U Tesla GPU Server with NVLink



IBM AC922 Power System Deep Learning Server (4-GPU Config)

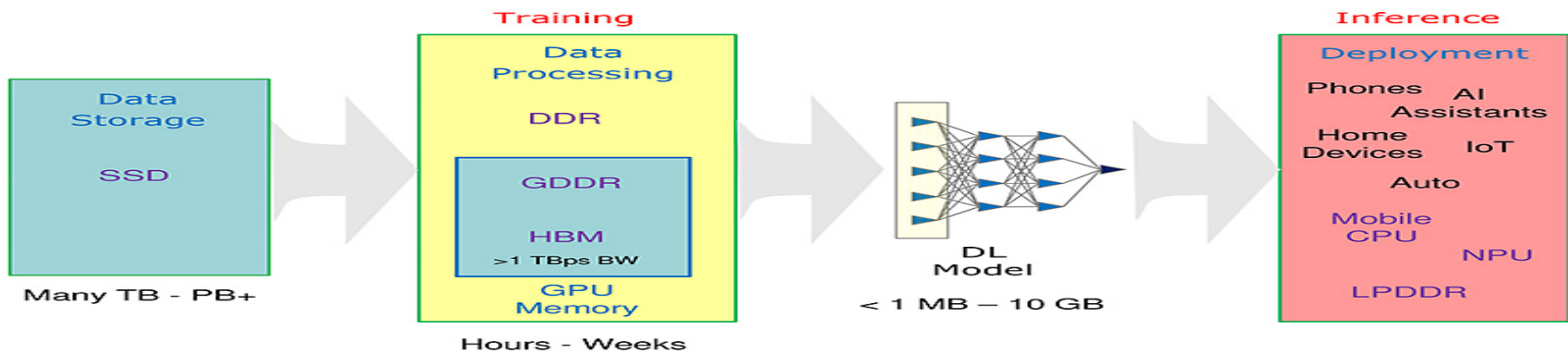
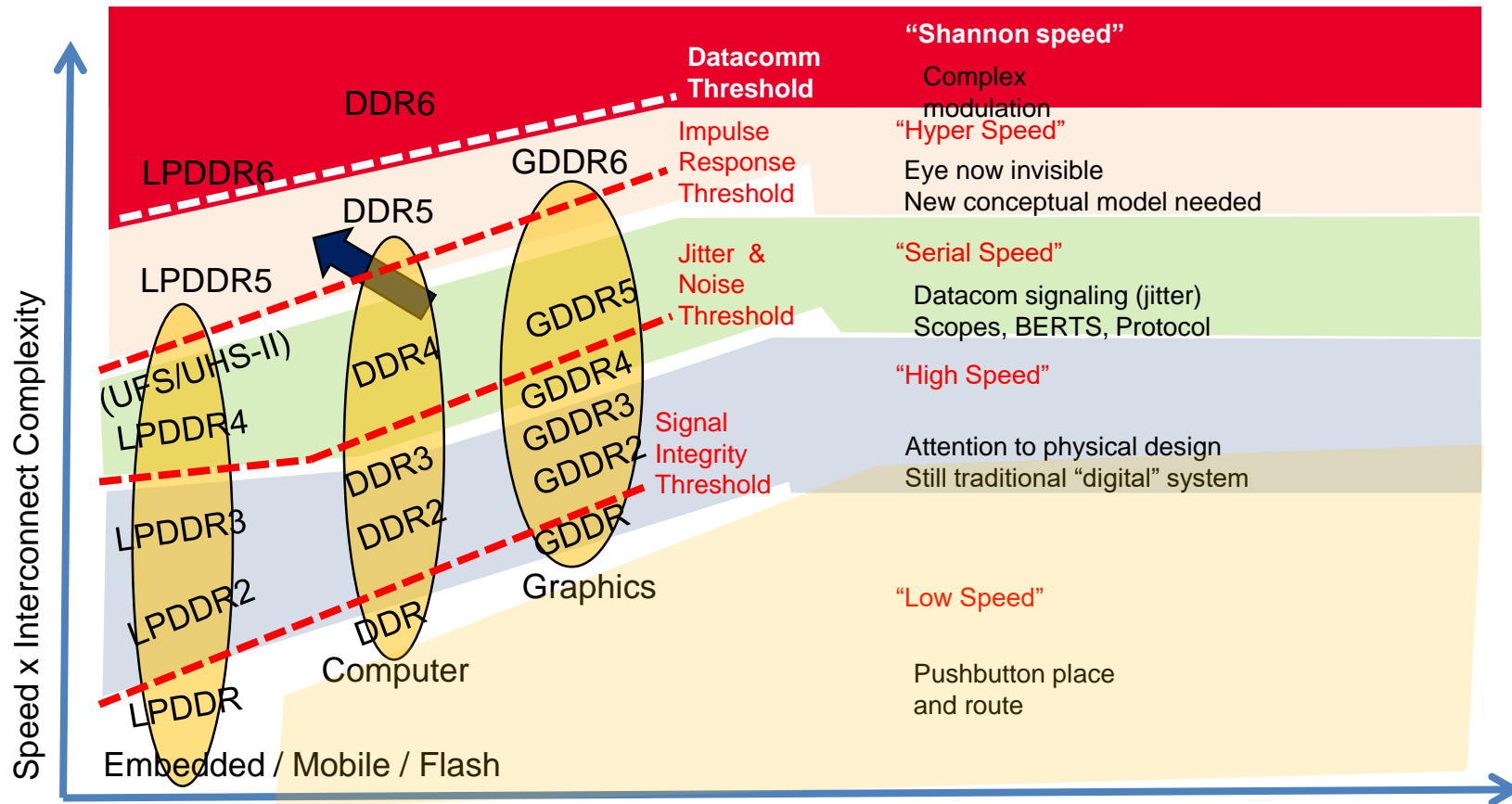


异构总线发展



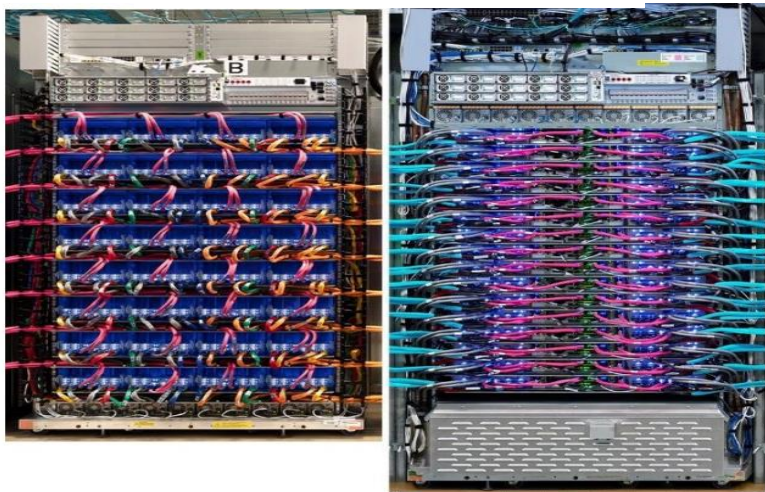
Standard	Phy. Layer	Data Rate	Coding	Future
PCIe	PCIe 4.0	16G NRZ	128b/130b	5.0 32G NRZ 6.0 32G PAM4
CCIX	CEI-25G-LR/28G-SR PCIe 4.0	25G/20G NRZ 16G NRZ	128b/130b 128b/130b	56G/64G NRZ
GenZ	IEEE 802.3(100G-KR) PCIe 4.0	25G NRZ 16G NRZ	64b/66b 128b/130b	32G/50G NRZ
OpenCAPI	BlueLink (CEI-28G-SR)	25G NRZ	64b/66b	32G/50G NRZ/PAM4

AI 计算对存储的要求



高速400G+/800G+ 光/电互联技术

电互联



机架：TPUv2(左)和 TPUv3(右)

光互联

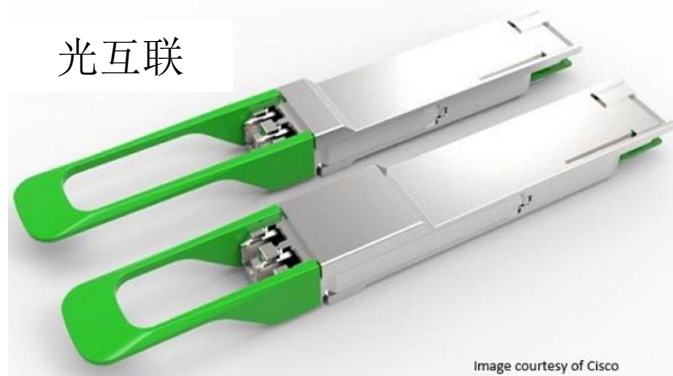
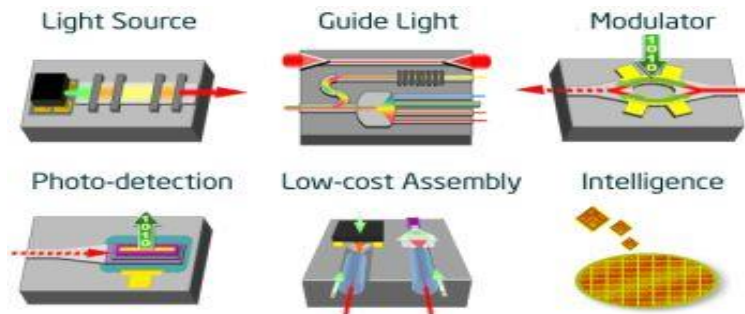
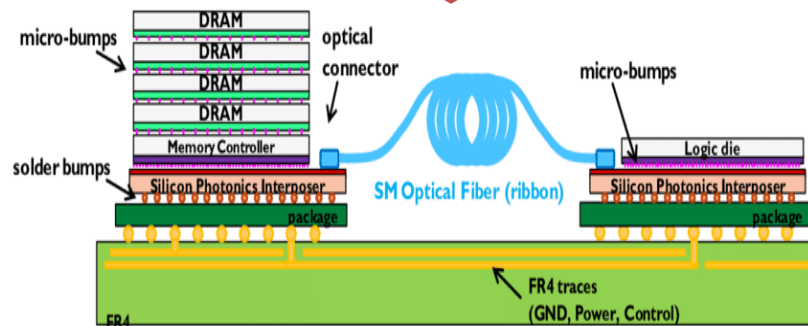


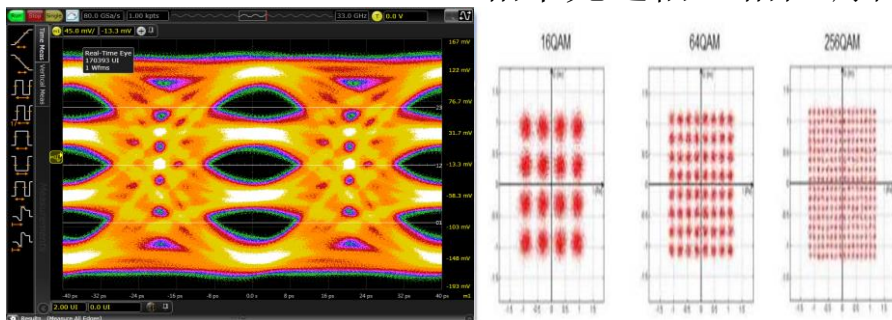
Image courtesy of Cisco



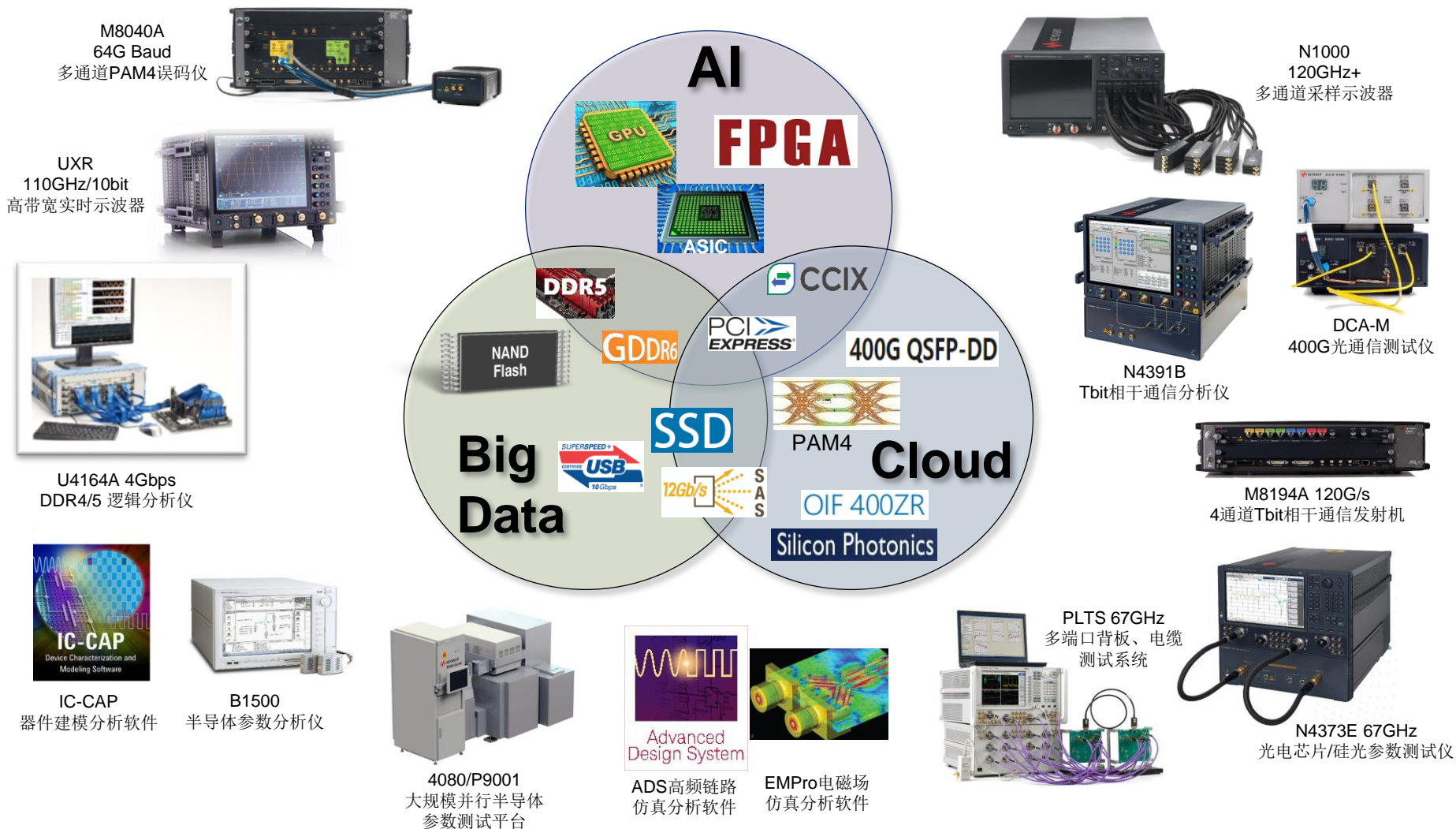
硅光集成



多电平调制 (PAM-4) 相干光通信 (相位调制)



Keysight AI芯片及数据中心测试方案



高速异构互联总线测试 (CCIX & PCIe-4/5)



高性能误码仪:

- 高速NRZ/PAM4信号产生和误码检测
- 内置4阶预加重和复杂抖动注入
- 实时NRZ/PAM-4 误码检测

高带宽高精度示波器:

- 110 GHz带宽 InP前端, 4 个全带宽通道
- 10bit ADC, 256GSa/s采样率

400G+/800G+ 光/电互联平台测试

M8190A

- 12 GSa/s
- 5 GHz BW



M8195A

- 64 GSa/s
- 25 GHz BW



M8196A

- 92 GSa/s
- 32 GHz BW



M8194A

- 120 GSa/s
- 45 GHz BW



- Multi-level / Multi-channel digital signals up to 100 GBaud PAM4
- Stimulus for coherent optical applications up to 100 GBaud / 64-QAM

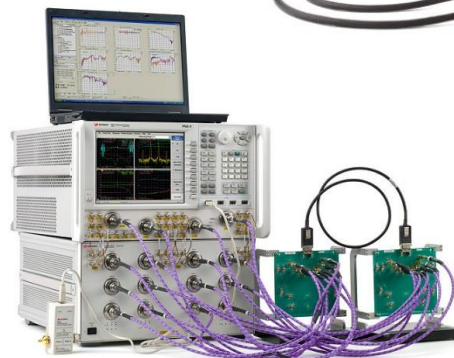
N5290A
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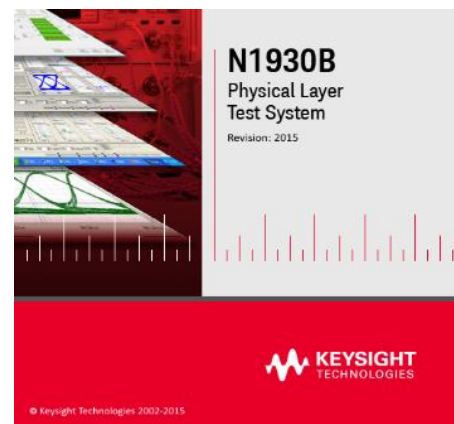
4端口, 120GHz



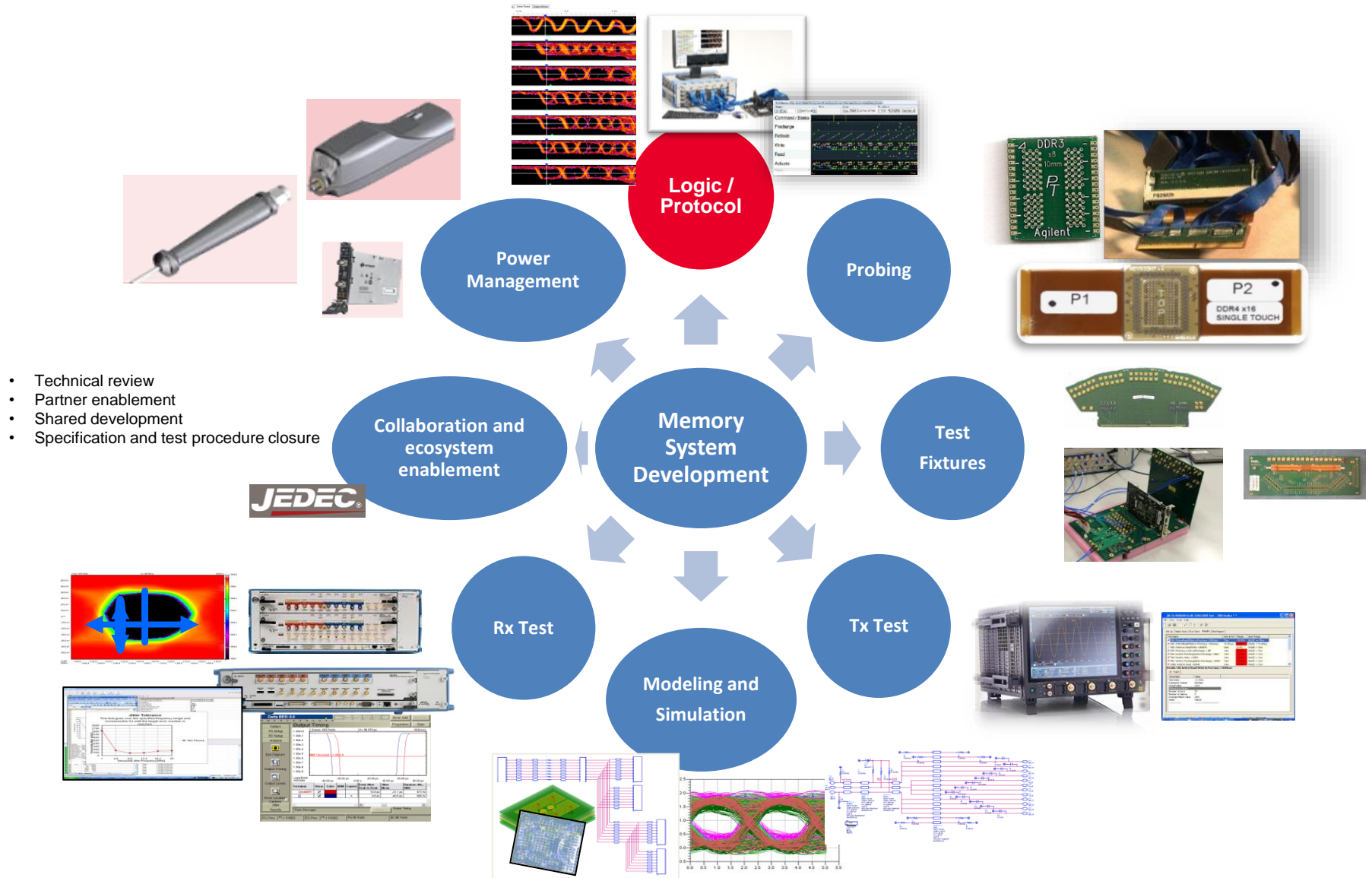
2~32端口, 26.5GHz



2~16端口, 67GHz



新型存储技术测试解决方案



总结

- AI 计算需求：算力加速、算法加速、带宽加速、数据存取加速；
- 算力和算法加速催生CPU、GPU、FPGA、ASIC等多种异构架构，量子 and 类脑计算是可能的未来；
- 带宽加速推动高速、低延时、开放的异构总线发展；在数据中心尺度，400G+及硅光逐渐开始商用；
- 数据存取加速迫切需要新的内存技术，DDR5/GDDR6/HBM等技术会逐渐成熟；
- Keysight公司提供针对高速异构总线、新型存储、高速光/电互联、量子计算、能耗分析等全面测试解决方案。